

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: John Davis Holder Art Unit: 1722
Serial No.: 10/002,862
Filed: November 15, 2001
Confirmation No.: 4783
For: INTERMITTENT FEEDING TECHNIQUE FOR INCREASING
THE MELTING RATE OF POLYCRYSTALLINE SILICON
Examiner: Matthew J. Song

July 5, 2007

REPLY BRIEF

This is a reply to the Examiner's Answer dated May 4, 2007.

I. APPELLANT'S COMMENTS ON EXAMINER'S ANSWER

In response to the Examiner's Answer, Appellant respectfully submits that the ordinarily skilled person would have had no reason to modify the polycrystalline silicon feeding method disclosed in the cited Holder reference (U.S. 5,588,993) with any aspect of the method disclosed by Kamio et al. (U.S. 5,087,429) to arrive at Appellant's invention as defined by the claims. Simply stated, the respective silicon feed methods disclosed by the Holder and Kamio et al. references are so different that an ordinarily skilled person would have concluded that the Kamio et al. reference does not disclose anything that would suggest a useful modification to Holder's method.

As recently held by the Supreme Court, the Office must articulate a sufficient rational underpinning to (i.e., express reasons supporting) the legal conclusion of obviousness. In this case, the Office must expressly state a reason why the ordinarily skilled person would have modified Holder's method with the very different Kamio et al. method. This requirement was expressed by the Supreme Court at page *13 of *KSR*

International v. Teleflex, 2007 WL 1237837 (U.S.), 82 U.S.P.Q.2d 1385, in which the Court approved of the holding of *In re Kahn*:

To facilitate with review, this analysis should be made explicit. *In re Kahn*, 441 F. 3d 977, 988 (CA Fed. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, **there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness**").

The KSR Supreme Court additionally approved the holding of *United States v. Adams*, at *14:

As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.

The Office's conclusion of obviousness rests essentially on the assertion stated on pages 3 and 4 of the Answer that "...it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Holder by using an intermittent flow because there are only two types of flow, intermittent or continuous, as evidenced by Kamio et al. and the selection of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution, *Ex parte Novak...*" Appellant submits that this assertion is a mere conclusory statement and does not provide a sufficient rational underpinning showing why the ordinarily skilled person would have combined the references. Rather, the references disclose such widely different feeding methods that the ordinarily skilled person would not have found any reason to

combine the cited references to arrive at the invention defined by Appellant's claims.

As a general matter, Holder's polycrystalline silicon feeding method is directed to preparing a silicon melt **prior to** single crystal silicon ingot pulling according to the conventional Czochralski method. Kamio et al., on the other hand, disclose a method for replenishing a silicon melt from which a crystal ingot is **simultaneously** being pulled. Any reference in Kamio et al. to feeding, intermittent or otherwise, is in the context of replenishment in a **continuous** crystal pulling process that employs a **constant-height** melt. The ordinarily skilled person would not have gleaned any useful information from the disclosure of an intermittent process for maintaining the height of the melt for modifying the Holder process, which produces a discrete melt **batch**, such that the melt height **increases** during silicon feeding.

The different goals of the respective references result in further differences between the methods that cannot be ignored when assessing the propriety of combining the references in the manner asserted by the Examiner. For example, in Holder's method, the polycrystalline silicon is fed into the center of the crucible and onto an island of unmelted, polycrystalline silicon. See Figures 2 and 3 of Holder and Col. 4, line 66 to Col. 5, line 4. In sharp contrast, Kamio et al. feed their silicon off-center and nearer to the crucible wall. See Figures 1, 6, 8, and 10. Holder feeds solid silicon onto the island of unmelted silicon in the center of the crucible to afford the silicon a sufficient time to dehydrogenate. Kamio et al. feed their silicon off-center because it is simply not possible to feed in the center during crystal pulling. Moreover, Kamio et al. equip their crucible apparatus with various guard means to protect against splashing that may occur when added silicon impacts the melted silicon in the crucible. See Figures 2, 7,

9, and 11. The ordinarily skilled person would have recognized that off-centered and guarded feeding is critical to avoid damaging the growing crystal ingot. This is not a concern in Holder's method (and Appellant's method) because their silicon feeding occurs prior to crystal ingot pulling.

The differences between the references can be summarized thusly:

Holder	Kamio et al.
1. Prepare entire silicon melt first, followed by crystal ingot pulling	1. Simultaneous melt replenishment and crystal ingot pulling
2. Melt height increases during polycrystalline silicon feeding	2. Melt height stays constant since feeding and crystal ingot pulling occur simultaneously
3. Feeding of polycrystalline silicon onto island of unmelted silicon present in crucible	3. Silicon is fed onto already melted silicon and steps must be taken to avoid splashing and damaging the growing crystal ingot
4. Center feeding to afford added polycrystalline silicon adequate time to dehydrogenate	4. Off-center feeding since center feeding is impossible during crystal ingot pulling
5. Center feeding to afford added solid polycrystalline silicon adequate time to dehydrogenate	5. Feeding directly into molten silicon does not afford solid silicon time to dehydrogenate

Given these differences, among others, between the references, Appellant submits that the ordinarily skilled person would have found no reason to combine the references to arrive at Appellant's invention as defined by the claims. Simply stated, in view of these differences, the Kamio et al. reference does not provide the ordinarily skilled person any guidance for improving Holder's feeding method, and likewise, the Holder reference does not provide the ordinarily skilled person any guidance for improving Kamio et al.'s feeding method.

As a final note, Appellant respectfully submits that neither reference renders the various dependent claims directed to flow rate, on and off durations, wedge shapes, etc. obvious.

The Office's basis for obviousness with regard to the various dependent claims is that, once the *prima facie* case is established for the independent claims, the variables required by the dependent claims is a mere matter of "optimization." Appellant submits that this conclusion is distorted by hindsight bias inasmuch as the Office's conclusion of obviousness of these variables was determined using knowledge gleaned only from Appellant's disclosure and not from knowledge available in the prior art.

II. CONCLUSION

Appellant submits that the claims are patentable for the reasons stated herein and for all of the reasons already made of record. Accordingly, Appellant respectfully requests that the Office's rejection of claims 1-107 be reversed and that claims 1-107 be allowed.

Respectfully submitted,



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